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PATENT ABSTRACTS OF JAPAN

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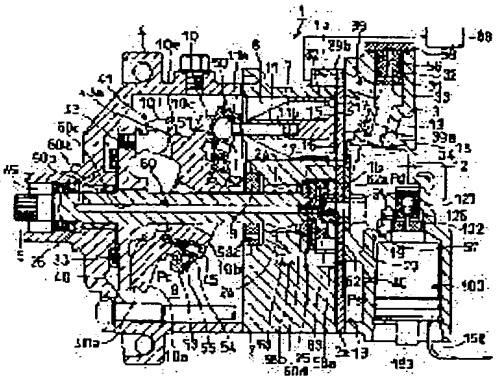
(54) CONTROL VALVE FOR VARIABLE DISPLACEMENT COMPRESSOR

(57)Abstract:
PROBLEM TO BE SOLVED: To improve valve opening and closing accuracy by disposing a control valve main body changing an inclined angle of a swash plate on the side of a rear housing and providing low temperature coolant gas introducing space which is communicated with an inlet pressure area of a compressor between a solenoid housing and a rear housing.
SOLUTION: The change of discharge capacity of a variable displacement compressor 1 is performed by adjusting the opening of a spherical valve element 126 of a control valve 100 interposed in a coolant gas path communicating a discharge pressure area and a crank chamber 8 by energizing force of a solenoid incorporated into the control valve 100 and changing an inclined angle of a swash plate 10 within the crank chamber 8. At this time, the control vale 100 is buried on the side of a rear housing 3 of the compressor 1, low temperature coolant gas introducing space which is communicated with an inlet pressure area of the compressor 1 is formed between a solenoid housing and the rear housing 3 of the control valve 100 and an inlet port is communicated. As a result, the control valve 100 is cooled by low temperature coolant gas from the side of a suction chamber 13 and overheat of the solenoid is prevented.



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* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] An excitation operation of the solenoid inside solenoid housing in which it is prepared by the control valve main part adjusts the opening of the valve element arranged at the refrigerant gas passageway which opens the discharge-pressure field and crank case of a variable-capacity type compressor for free passage. In the control valve for variable-capacity type compressors which changed the discharging volume of the aforementioned compressor by changing the degree of tilt angle of the cam plate in the aforementioned crank case the aforementioned control valve main part The control valve for variable-capacity type compressors characterized by preparing the low-temperature refrigerant-gas introduction space which is open for free passage to the inlet-pressure field of the aforementioned variable-capacity type compressor between the aforementioned solenoid housing and the aforementioned rear housing while being laid under the rear housing side of the aforementioned variable-capacity type compressor.
[Claim 2] The control valve for variable-capacity type compressors which changed the discharging volume of the aforementioned compressor by an excitation operation of the solenoid inside solenoid housing in which it is prepared by the control valve main part adjusting the opening of the valve element arranged at the refrigerant gas passageway which is characterized by providing the following, and which opens the discharge-pressure field and crank case of a variable-capacity type compressor for free passage, and changing the degree of tilt angle of the cam plate in the aforementioned crank case. The aforementioned control valve main part is a pressure-sensitive room which is open for free passage to the inlet-pressure field of the aforementioned variable-capacity type compressor. A stretching screw electrode holder with the stretching screw which is connected in the direction in which the opening will decrease the aforementioned valve element if it holds in this pressure-sensitive interior of a room and the pressure of the aforementioned inlet-pressure field rises by the sealing state at the bellows to which it is made to move, and the aforementioned pressure-sensitive room, and adjusts the strength of the aforementioned bellows.
[Claim 3] The aforementioned control valve main part is a control valve for variable-capacity type compressors according to claim 2 characterized by being laid under the rear housing side of the aforementioned variable-capacity type compressor where the aforementioned stretching screw electrode holder is turned outside.
[Claim 4] The aforementioned stretching screw electrode holder is a control valve for variable-capacity type compressors according to claim 2 characterized by being the airtight cap who unified the aforementioned stretching screw.
[Claim 5] An excitation operation of the solenoid inside solenoid housing in which it is prepared by the control valve main part adjusts the opening of the valve element arranged at the refrigerant gas passageway which opens the discharge-pressure field and crank case of a variable-capacity type compressor for free passage. In the control valve for variable-capacity type compressors which changed the discharging volume of the aforementioned compressor by changing the degree of tilt angle of the cam plate in the aforementioned crank case the aforementioned control valve main part The control valve for variable-capacity type

compressors characterized by arranging the pressure-sensitive room which arranged the solenoid in the center section and arranged bellows in the end section, and the valve chest which arranged the aforementioned valve element in the other end.
[Claim 6] The control valve for variable-capacity type compressors according to claim 5 which fix the end of a stem to the end of the plunger of the aforementioned solenoid, and contact arrangement of the attachment and detachment of the stopper of the aforementioned bellows arranged in the aforementioned pressure-sensitive room is enabled at the other end of this stem, and is characterized by carrying out connection fixation of the rod which contacts the aforementioned valve element at the other end of the aforementioned plunger.
[Claim 7] The control valve for variable-capacity type compressors according to claim 6 characterized by the spring which energizes this plunger to the aforementioned valve element side being arranged by the end of the plunger of the aforementioned solenoid.
[Claim 8] The aforementioned valve element is a control valve for variable-capacity type compressors given in the claim 1 characterized by considering as the shape of a globular form, or any 1 term of 7.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the control valve for variable-capacity type compressors used for air conditioners, such as vehicles, and relates to the control valve for variable-capacity type compressors which controls supply of the refrigerant gas from a discharge-pressure field to into a crank case especially if needed.
[0002]
[Description of the Prior Art] From the former, the variable-capacity type compressor equipped with the cylinder, the piston, the cam plate, etc. is used in order to compress and carry out the regurgitation of the refrigerant gas of the conditioner for automobiles, and what was constituted so that the degree of tilt angle of a cam plate might be changed and discharging volume might be changed is known by equipping this variable-capacity type compressor with the refrigerant gas passageway which opens a discharge-pressure field and a crank case for free passage, and adjusting the pressure in the aforementioned crank case. Pressure regulation in a crank case is performed by opening adjustment of the control valve prepared in the middle of the aforementioned refrigerant gas passageway by supplying a high-pressure compression refrigerant gas to the aforementioned crank case from the aforementioned discharge-pressure field.
[0003] As such a control valve, there is control valve 100' for variable-capacity type compressors (only henceforth a control valve) as shown in drawing 6 and drawing 7 , for example (refer to JP,9-268974,A). This control valve 100' is prepared in the rear housing 210 side of the variable-capacity type compressor 200, and performs pressure regulation of the crank case 231 in the front housing 230 it is connected [front / cylinder block / of the variable-capacity type compressor 200 / 220].
[0004] Here, while the cam plate 240 as a cam plate is supported by the crank case 231 interior possible [a slide in the direction of an axis of the drive shaft 250], and possible [****], the guide pin 241 of a cam plate 240 is supported by it free [a slide on the support arm 252 of the rotation base material 251]. Moreover, the cam plate 240 is connected with the piston 260 currently arranged free [sliding] in the cylinder bore 221 through the shoe 242 of the couple of this cam plate 240.
[0005] And according to the difference of the suction pressure Ps in a cylinder bore 221, and the crank case pressure Pc in the aforementioned crank case 231, the aforementioned cam plate 240 performs rotation operation in the direction of an arrow, and changes the degree of tilt angle. Based on this degree of tilt angle, the stroke width of the longitudinal slide movement within the cylinder bore 221 of a piston 260 is determined. moreover, the interception object 270 which is in contact with the mountain side section of a cam plate 240 with rotation operation to the direction of an arrow of a cam plate 240 -- hold -- longitudinal slide movement of the inside of a hole 222 is carried out
[0006] Furthermore, partition formation of the regurgitation rooms 212a and 212b which constitute Inhalatoriums 211a and 211b and the discharge-pressure field which constitute an inlet-pressure field in the aforementioned rear housing 210 is carried out. In a piston 260 operating approximately based on rotation of the aforementioned cam plate 240, after the

refrigerant gas in inhalatorium 211a is compressed until it was inhaled in the cylinder bore 221 from the inhalation port 213 and reached the predetermined pressure after that, it is breathed out by regurgitation room 212a from the regurgitation port 214.
[0007] furthermore, the inhalation path 215 formed in a part for the core of the rear housing 210 again — the aforementioned hold — while it is open for free passage to a hole 222, it is open for free passage to the aforementioned inhalatorium 211b through a through-hole 216 And when a cam plate 240 moves to the interception object 270 side, for example, the interception object 270 moves to the aforementioned inhalation path 215 side, and closes a through-hole 216 with the interception object 270 soon.
[0008] Moreover, between the aforementioned inhalation path 215 and the upper-limit section side of aforementioned control valve 100', the pressure-taking path 217 for drawing suction pressure Ps in this control valve 100' is formed. Furthermore, while the aforementioned regurgitation room 212b and the aforementioned crank case 231 are opened for free passage through the air-supply path 218 and the air-supply path 219 of control valve 100', these air-supply paths 218 and the air-supply path 219 are opened and closed by valve element 106of control valve 100' '. Here, the discharge pressure Pd of regurgitation room 212b is led to valve chest port 113' through the air-supply path 218, and the aforementioned crank case internal pressure Pc is led to port 114' through the air-supply path 219. Furthermore, the aforementioned suction pressure Ps is led to inlet-pressure introduction port 115' through the aforementioned pressure-taking path 217.
[0009] And when [for example,] an air conditioner is operation switched [280] off and the detection temperature obtained from the indoor sensor 281 is more than the setting temperature of the room temperature setter 282, If a control computer 283 orders it excitation of solenoid 101' of aforementioned control valve 100' and predetermined current is supplied through the drive circuit 284, with the suction force by this solenoid 101' Movable iron core 102' resists the energization force of spring 103', and can draw near to a fixed iron core 104' side.
[0010] With movement of this movable iron core 102', valve element 106' attached in solenoid rod 105' resists the energization force of compulsive opening spring 107', and moves the degree of valve-opening of valve port 108' to the side which decreases. Bellows 111' connected with this valve element 106' free [attachment and detachment] through pressure-sensitive rod receptacle section 110' because pressure-sensitive rod 109' prepared in one goes up is forced with movement of valve element 106'.
[0011] At this time, this bellows 111' is displaced according to change of the suction pressure Ps introduced in pressure-sensitive room 112' through the pressure-taking path 217, and gives a load to aforementioned pressure-sensitive rod 109'. That is, the degree of valve-opening of aforementioned valve port 108' by aforementioned valve element 106' is determined by the balance of the suction force according [control valve 100'] to aforementioned solenoid 101', the energization force from aforementioned bellows 111', and the energization force of aforementioned forcible opening spring 107'.
[0012] Here, when the difference of the detection temperature of the aforementioned indoor sensor 281 and the setting temperature of the room temperature setter 282 is large when a cooling load is large namely, the suction force between movable iron core 102' and fixed iron core 104' is strengthened, and opening and closing of aforementioned valve element 106' are performed more by the low suction pressure Ps because the energization force to the direction where the degree of valve-opening of valve port 108' by aforementioned valve element 106' decreases increases.
[0013] If the degree of valve-opening by this valve element 106' becomes small, the refrigerant capacity through the air-supply path 218 and the air-supply path 219 from aforementioned regurgitation room 212b to the aforementioned crank case 231 will decrease, and the crank case pressure Pc in the aforementioned crank case 231 will also become low. Moreover, when the aforementioned cooling load is large, the suction pressure Ps in the aforementioned cylinder bore 221 is high, a difference arises to the suction pressure Ps in this cylinder bore 221, and the crank case pressure Pc in the aforementioned crank case 231, the degree of tilt angl of the aforementioned cam plate 240 is large, by the bird clapper, the aforementioned interception

object 270 separates from the aforementioned inhalation path 215 side, and a path 216 is opened.

[0014]

[Problem(s) to be Solved by the Invention] By the way, in conventional control valve 100' which was mentioned above, as shown in drawing 7 , a discharge pressure Pd is led to valve chest port 113of control valve 100' ' through the aforementioned air-supply path 218. This discharge pressure Pd is high pressure, and in order to release high temperature by being compressed until the refrigerant gas which moreover brings about a discharge pressure Pd reaches a predetermined pressure by operation before and after the aforementioned piston 260, aforementioned control valve 100' itself will become an elevated temperature according to this high temperature.

[0015] Thus, when control valve 100' itself becomes an elevated temperature, since the temperature of solenoid 101' also rises, there is a problem that the suction force of aforementioned movable iron core 102' by this solenoid 101' will decline, and the opening-and-closing precision of aforementioned valve port 108' by aforementioned valve element 106' will fall. Moreover, in conventional control valve 100', since the space which needs to incorporate aforementioned bellows 111' in pressure-sensitive room 112' where the aforementioned interior of pressure-sensitive room 112' is considered as sealing, and inserts an adjustment fixture etc. from the exterior cannot be provided, it is impossible to adjust the load force of aforementioned bellows 111'.

[0016] Furthermore, since it is in the state where the point of application of suction to solenoid rod 105' by aforementioned solenoid 101' and the point of application of the energization force by aforementioned bellows 111' separated, Since the point of aforementioned valve element 106' which blockades about [that there is a possibility that it may be generated with backlash in this solenoid rod 105'], and aforementioned valve port 108' is only made into the flat configuration at the time of movement of aforementioned solenoid rod 105' at the time of valve closing, It is hindrance when a possibility that aforementioned valve element 106' may contact aforementioned valve port 108' unequally also raises valve-opening close precision with [aforementioned] backlash for a certain reason. While this invention is made in view of such a trouble and the purpose raises valve-opening close precision, it is offering the control valve for variable-capacity type compressors which can adjust the load force of bellows easily.

[0017]

[Means for Solving the Problem] The control valve for variable-capacity type compressors concerning this invention that the aforementioned purpose should be attained An excitation operation of the solenoid inside solenoid housing in which it is prepared by the control valve main part adjusts the opening of the valve element arranged at the refrigerant gas passageway which opens the discharge-pressure field and crank case of this variable-capacity type compressor for free passage. While changing the discharging volume of the aforementioned compressor and laying the aforementioned control valve main part under the rear housing side of the aforementioned variable-capacity type compressor by changing the degree of tilt angle of the cam plate in the aforementioned crank case It is characterized by preparing the low-temperature refrigerant-gas introduction space which is open for free passage to the inlet-pressure field of the aforementioned variable-capacity type compressor between the aforementioned solenoid housing and the aforementioned rear housing.

[0018] The control valve for variable-capacity type compressors concerning this invention constituted like the above While a low-temperature refrigerant gas is introduced into the pressure-sensitive interior of a room of a control valve main part from the aforementioned inhalation field Since this low-temperature refrigerant gas is led also to the low-temperature refrigerant-gas introduction space prepared between the aforementioned solenoid housing and the aforementioned rear housing and makes the whole side of this solenoid housing cool by this hot-cold intermediation gas The fall of the excitation force of the solenoid inside housing based on heat etc. can be suppressed.

[0019] Moreover, the pressure-sensitive room which is open for free passage in the inlet-pressure field of a variable-capacity type compressor on the aforementioned control valve main

part, The bellows made to move the aforementioned valve element in the direction in which the opening decreases when it holds in this pressure-sensitive interior of a room and the pressure of the aforementioned inlet-pressure field rises, The strength of the bellows of this pressure-sensitive indoor section can be adjusted easily, maintaining the sealing state of the aforementioned pressure-sensitive indoor section, since the stretching screw electrode holder with the stretching screw which is connected [room / pressure-sensitive / aforementioned] by the sealing state, and adjusts the strength of the aforementioned bellows was provided.

[0020] Furthermore, by laying the aforementioned control valve main part under the rear housing side of the aforementioned variable-capacity type compressor, where the aforementioned stretching screw electrode holder is turned outside, even if it is in the state which equipped this rear housing with this control valve main part, the strength of the bellows of the aforementioned pressure-sensitive indoor section can be easily adjusted from the outside.

[0021] Furthermore, the pressure-sensitive room where the aforementioned control valve main part arranged the solenoid in the center section, and arranged bellows in the end section again, And arrange the valve chest which arranged the aforementioned valve element in the other end, and the end of a stem is fixed to the end of the plunger of the aforementioned solenoid. The stopper of the bellows arranged in the aforementioned pressure-sensitive room at the other end of this stem enables contact arrangement of the attachment and detachment. Since the spring which carries out connection fixation of the rod which contacts the other end of the aforementioned plunger at the aforementioned valve element, and energizes this plunger at the end of the plunger of the aforementioned solenoid at the aforementioned valve element side was arranged When the aforementioned plunger is not excited by the solenoid, the aforementioned valve element can always be changed into the state of the maximum opening position, without being influenced by operation of the bellows of the aforementioned pressure-sensitive interior of a room.

[0022] Moreover, it is stopped with [of this operation lever at the time of movement in the direction of valve-closing of the aforementioned rod or a stem which constitutes an operation lever from the point of application by suction of this solenoid and the point of application by the aforementioned bellows having been close brought by having carried out approach arrangement of the aforementioned pressure-sensitive room and the solenoid] backlash by necessary minimum. Moreover, even if it is the case where an inclination arises for the aforementioned operation lever at the time of a valve-closing operation, the aforementioned valve element can be made to contact equally to a valve port by making the aforementioned valve element into the shape of a globular form.

[0023]

[Embodiments of the Invention] Hereafter, a drawing explains the gestalt of 1 operation of the control valve for variable-capacity type compressors of this invention. Drawing of longitudinal section and drawing 2 which drawing 1 and drawing 2 show the variable-capacity type compressor 1 equipped with the control valve 100 of this operation gestalt, and show the state where the regurgitation path of this variable-capacity type compressor 1 opened drawing 1 are drawing of longitudinal section showing the state where the regurgitation path closed. The front housing 4 is being fixed to the other end side for the rear housing 3 through valve-plate 2a by the end side of the cylinder block 2 of the variable-capacity type compressor 1, respectively. Two or more cylinder bores 6 are arranged in the hoop direction every predetermined interval focusing on the shaft (axis of rotation) 5 by the cylinder block 2. In these cylinder bores 6, the piston 7 is held possible [sliding], respectively.

[0024] A crank case 8 is formed in the front housing 4, and the cam plate 10 is contained in this crank case 8. The shoe 50 supported possible [relative rolling of end section 11a of the shape of a sphere of a connecting rod 11] is held by the retainer 53 at sliding-surface 10a of this cam plate 10. Boss section 10b of a cam plate 10 is equipped with a retainer 53 through radial bearing 55, and relative rotation is possible for it to a cam plate 10. Radial bearing 55 is escaped from, stopped and carried out by the stopper 54 which ****ed to boss section 10b and was fixed by 45.

[0025] The shoe 50 consists of a main part 51 of a shoe supported possible [relative rolling of

the apical surface of end section 11a of a connecting rod 11], and a washer 52 supported possible [relative rolling of the back end side of end section 11a of a connecting rod 11]. The regurgitation room 12 and the inhalatorium 13 are formed in the rear housing 3. This inhalatorium 13 is arranged so that the regurgitation room 12 may be surrounded. The inhalation mouth (illustration ellipsis) which leads to the outlet of an evaporator (illustration ellipsis) is prepared in the aforementioned rear housing 3. Drawing 1 shows the state where the regurgitation path 39 opened, and drawing 2 shows the state where this regurgitation path 39 closed. It consists of path 39b formed in path 39a by which the spool type valve (regurgitation control valve) 31 is formed in the middle of, and the regurgitation path 39 was formed in the rear housing 3 and valve-plate 2a. [the regurgitation path 39 which makes the aforementioned regurgitation room 12 and delivery 1a open for free passage] Path 39b leads to delivery 1a formed in the cylinder block 2.

[0026] The spring (energization member) 32 was held in the cylinder-like-object-with-base-like spool type valve 31, the end of a spring 32 contacted the stopper 56 fixed to the aforementioned rear housing 3 with the cap 59, and the other end of the aforementioned spring 32 is in contact with the base of a spool type valve 31. The building envelope 33 of this spool type valve 31 is open for free passage to the crank case 8 through a path 34.

[0027] The energization force of a spring 32 and the pressure of a crank case 8 act on one side (above) of the aforementioned spool type valve 31 in the valve-closing direction (direction where the degree of valve-opening becomes small). Delivery 1a and the **** room 12 are open for free passage through the **** path 39 at the time of valve opening of the aforementioned spool type valve 31 (refer to drawing 1). Therefore, in another side of a spool type valve 31, the pressure of delivery 1a and the pressure of the **** room 12 act in the valve-opening direction (direction where the degree of valve-opening becomes large). However, when the pressure differential of a crank case 8 and delivery 1a becomes below a predetermined value, a spool type valve 31 moves in the valve-closing direction, the **** path 39 is intercepted, and only the pressure of the **** room 12 acts on the spool-type-valve 31 bottom in the valve-opening direction. The pressure of delivery 1a stops namely, acting on the spool-type-valve 31 bottom.

[0028] The **** room 12 and a crank case 8 are open for free passage through the second path 57. In the middle of the path 57, the control valve (control valve for variable-capacity type compressors) 100 of this operation form which mentions a detail later is formed. When a thermal load is large, a valve element 126 sits down by energization to solenoid 131A of this control valve 100, the second path 57 is intercepted, when a thermal load is small, a valve element 126 separates from a valve seat by energization halt to solenoid 131A, and the second path 57 is released. The operation of the aforementioned control valve 100 is controlled by the computer which is not illustrated.

[0029] The aforementioned inhalatorium 13 and a crank case 8 are open for free passage through the first path 58. the hole formed in orifice (second orifice) 58a by which this path 58 was formed in valve-plate 2a, path 58b formed in the cylinder block 2, and the ring (annular solid) 9 fixed to the shaft 5 -- it consists of 58c The inhalatorium 13 and the crank case 8 are open for free passage through the third path 60. This path 60 consists of path 60a formed in the front housing 4, front side shaft carrier hold space 60b, path 60c formed in the shaft 5, 60d of rear side shaft carrier hold space formed in the cylinder block 2 and path 58b of a cylinder block 2, and orifice 58of valve-plate 2a a. Path 58b of a cylinder block 2 and orifice 58of valve-plate 2a a constitute a part of third path 60 while constituting a part of first path 58 of the above.

[0030] A female screw 61 is formed in the inner skin of the rear side edge section of the aforementioned path 60c, and the screw 62 is thrust into this female screw 61. Orifice (first orifice) 62a is formed in this screw 62, and the path area of this orifice 62a is smaller than the path area of second orifice 58a of valve-plate 2a which constitutes a part of first path 58 of the above on it. therefore, boss section 10b of a cam plate 10 -- the hole of a ring 9 -- only when 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the refrigerant of a crank case 8 is led to an inhalatorium 13 through the third path 60

[0031] The inhalation port 15 which makes aforementioned valve-plate 2a open for free passage **** POTO 16 which makes compression space 82 and the **** room 12 open for free passage,

and compression space 82 and an inhalatorium 13 is established in the hoop direction every predetermined interval, respectively. The **** port 16 is opened and closed by the discharge valve 17, and this discharge valve 17 is being fixed to the rear housing side edge side of valve-plate 2a with the bolt 19 and the nut 20 with the valve guard 18. Moreover, the inhalation port 15 is opened and closed by the suction valve portion 21, and the suction valve portion 21 is arranged between valve-plate 2a and the cylinder block 2.

[0032] The rear side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (rear side shaft carrier) 24 and thrust bearing (rear side shaft carrier) 25 which were contained by 60d of rear side shaft carrier receipt space of a cylinder block 2, and the front side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (front side shaft carrier) 26 held in front side shaft carrier hold space 60b of the front housing 4. The shaft seal 46 other than radial bearing 26 is held in bearing receipt space 60b by the side of a front.

[0033] Female screw 1b is prepared in the center section of the cylinder block 2, and the adjust nut 83 is screwing in this female screw 1b. By fastening this adjust nut 83, preloading is given to a shaft 5 through thrust bearing 25. Moreover, a pulley (illustration ellipsis) is fixed to the front side edge section of a shaft 5. The thrust flange 40 for transmitting rotation of a shaft 5 to a cam plate 10 is fixed to a shaft 5, and this thrust flange 40 is supported by the internal surface of the front housing 4 through thrust bearing 33. The thrust flange 40 and a cam plate 10 are connected through the hinge mechanism 41, and a cam plate 10 can incline to a shaft 5 and a right-angled virtual side. The shaft 5 is equipped with the cam plate 10 possible [sliding and an inclination].

[0034] The hinge mechanism 41 is with 10f of linear guide slots established in bracket 10e prepared in front side 10c of a cam plate 10, and this bracket 10e, and the rod 43 screwed in cam-plate side side 40a of the thrust flange 40, and is constituted. The longitudinal shaft of 10f of guide slots leans the degree of predetermined angle to front side 10c of a cam plate 10. Spherical section 43a of a rod 43 has fitted into the 10f of the aforementioned guide slots possible [relative sliding].

[0035] Next, control valve (only henceforth control valve) 100 the very thing for variable-capacity type compressors of this operation form is explained in detail. Drawing of longitudinal section showing the state where drawing 3 included the control valve 100 in the variable-capacity type compressor 1, and drawing 4 are the cross sections showing the detail of the control valve of drawing 3 . The control valve 100 shown in drawing 3 is formed in the rear housing 3 side of aforementioned drawing 1 and the variable-capacity type compressor 1 of drawing 2 , and the control valve main part 120 of a control valve 100 is arranged where airtightness is maintained at the space 84 opened for free passage by the aforementioned **** room 12 of the discharge pressure Pd of a refrigerant through O rings 121a and 121b. In the edge of the control valve main part 120, attachment fixation of the strainer 122 is carried out, and the refrigerant gas which brings the high-pressure discharge pressure Pd to the valve chest of the control valve main part 120 interior 123 interior through this strainer 122 is incorporated.

[0036] While the spherical valve element 126 which performs opening and closing of a stopper 124 and a valve port 125 is arranged in the valve chest 123 interior, between these stoppers 124 and the spherical valve element 126, the valve-closing spring 127 which energizes this spherical valve element 126 in the direction of valve-closing intervenes. Moreover, the port 114 where the crank case pressure Pc of this crank case 8 is led to the aforementioned control valve main part 120 while it is open for free passage through the aforementioned path 57 to the crank case 8 of drawing 1 is formed, and the high-pressure refrigerant gas led to the valve chest 123 interior of the above by opening of the aforementioned valve port 125 by the aforementioned spherical valve element 126 through the aforementioned strainer 122 is led to the aforementioned crank case 8 side from this port 114 and the aforementioned path 57.

[0037] Furthermore, while it is open for free passage to an inhalatorium 13 through the path 80 of drawing 1 , the inhalation port 129 to which the suction pressure Ps of this inhalatorium 13 is led is established in the aforementioned control valve main part 120. Moreover, this inhalation port 129 is open for free passage to the suction pressure introduction space 85 prepared between the aforementioned rear housing 3 and the solenoid housing 131 while being drawn in

the pressure-sensitive room 145 later mentioned through the inhalation path 130. Furthermore, this suction pressure introduction space 85 is sealed through O ring 131b of projected part 131a prepared in the flank of the solenoid housing 131. By forming the suction pressure introduction space 85, the whole side of the solenoid housing 131 is cooled by the refrigerant gas of the low temperature from the aforementioned inhalatorium 13 side, and the temperature rise of solenoid 131A of the solenoid housing 131 interior is stopped.

[0038] The plunger 133 by which connection fixation is carried out is arranged in the solenoid housing 131 interior by the rod 132 which contacts and carries out support fixation of the aforementioned spherical valve element 126. Moreover, this plunger 133 is supported free [sliding] with the pipe 136 attached in the pipe electrode holder 135 which touches a close state through O ring 134 to edge 120a of the aforementioned control valve main part 120. In addition, the aforementioned rod 132 constitutes the operation lever with the stem 138 mentioned later.

[0039] the hold currently formed in back end section 133a of a plunger 133 — while insertion fixation of the end section 139 of a stem 138 is carried out at the hole 137 — the other end 140 of the aforementioned stem 138 — hold of the suction child 141 — the hold from a hole 142 side — it is in the state projected to a hole 143 side, and is supported free [sliding] to the suction child 141 the hold by the side of the aforementioned plunger 133 — the hold by the side of a hole 137 and the aforementioned suction child 141 — between holes 142, the spring 144 energized in the direction which separates a plunger 133 from the suction child 141 side intervenes

[0040] Moreover, the other end 140 of a stem 138 is equipped with this stopper 147 side free [attachment and detachment] among the stoppers 147,148 of the couple of the bellows 146 interior currently arranged in the pressure-sensitive room 145. the flange 149 of this stopper 147, and the hold by the side of the aforementioned suction child 141 — between holes 143, the spring 150 energized in the direction which separates a stopper 147 from the suction child 141 side intervenes

[0041] And the suction pressure Ps in the pressure-sensitive room 145 becomes high, and when stopper 147,148 comrades of a couple contact by contraction of bellows 146, the maximum serious grade position of bellows 146 is regulated. moreover, the maximum of bellows 146 — a variation rate — since the amount is set up so that it may become smaller than the amount of the maximum fitting of the other end 140 of the aforementioned stem 138, and the stopper 147 of bellows 146, the other end 140 of the aforementioned stem 138 does not secede from the stopper 147 of the aforementioned bellows 146

[0042] Furthermore, while forming the aforementioned pressure-sensitive room 145, attachment fixation of the stretching screw electrode holder 152 is carried out at the pipe 151 by which adhesion maintenance is carried out through O ring 156 at the plate 157. While the stretching screw 153 which adjusts the strength of the aforementioned bellows 146 to the stretching screw electrode-holder 152 interior of this is formed in the close state through O ring 154, the edge 155 of a stretching screw 153 is in contact with the stopper 148 of the aforementioned bellows 146. Furthermore, the code 158 in which the predetermined exciting current controlled by the aforementioned control computer (illustration abbreviation) is supplied is connected to the aforementioned solenoid 131A side again.

[0043] Next, an operation with the variable-capacity type compressor 1 of this operation form and a control valve 100 is explained. The operation of the whole variable-capacity type compressor 1 is explained previously, and, subsequently the operation of a control valve 100 is explained. The rotational-motion force of a mounted engine is always transmitted to the aforementioned shaft 5 from the pulley which is not illustrated through the belt which is not illustrated, the turning effort of a shaft 5 is transmitted to a cam plate 10 through the thrust flange 40 and the hinge mechanism 41, and this cam plate 10 rotates it.

[0044] Since a shoe 50 carries out relative rotation of the sliding-surface 10a top of a cam plate 10 by rotation of a cam plate 10, the turning effort from a cam plate 10 is changed into straight-line reciprocating movement of a piston 7. This piston 7 moves the inside of a cylinder bore 6 reciprocately, as a result, the capacity of the compression space 82 in a cylinder bore 6 changes,

inhalation of a refrigerant gas, compression, and **** are performed one by one by this capacity change, and the refrigerant gas of capacity according to the degree of tilt angle of a cam plate 10 is breathed out. At the time of inhalation, a suction valve portion 21 opens and a low-pressure refrigerant gas is breathed out from an inhalatorium 13 to the compression space 82 in a cylinder bore 6.

[0045] If a thermal load becomes small (at the time of the clutch-off equivalent of a compressor with a clutch), the energization to the solenoid of a control valve 100 is stopped, and a control valve 100 (plunger 133) moves in the open direction, and the spherical valve element 126 of this control valve 100 will resist the energization force of the valve-closing spring 127, it will move in the valve-opening direction, and the second path 57 will open. Consequently, a high-pressure refrigerant gas flows out of the **** room 12 into a crank case 8 through the second path 57, and the pressure of this crank case 8 becomes high.

[0046] And the force concerning the rear side of the piston 7 in a compression stroke becomes large, and as a result of total of the force concerning the rear side of a piston 7 exceeding total of the force concerning the front side (top side) of a piston 7, the degree of tilt angle of a cam plate 10 becomes small. the time of the degree of tilt angle of a cam plate 10 becoming the minimum — boss section 10b of a cam plate 10 — the hole of a ring 9 — since 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the failure of pressure of a crank case 8 is suppressed

[0047] The pressure differential of the aforementioned regurgitation room 12 and a crank case 8 becomes below the predetermined value Po, and if resultant force with the pressure of a crank case 8 and the energization force of a spring 32 of acting on the spool-type-valve 31 bottom overcomes the pressure of the refrigerant gas of the regurgitation room 12 which acts on the spool-type-valve 31 bottom, the aforementioned spool type valve 31 will move in the valve-closing direction, and will intercept the regurgitation path 39 (drawing 2). Consequently, defluxion of the refrigerant gas from delivery 1a to a capacitor 88 is prevented. this time — above — boss section 10b of a cam plate 10 — the hole of a ring 9 — although 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the refrigerant gas in a crank case 8 flows to an inhalatorium 13 through the third path 60 While overpressure elevation of a crank case 8 is suppressed by this, circulation within the compressor 1 of a refrigerant gas is attained.

[0048] A refrigerant gas returns to an inhalatorium 13 again through an inhalatorium 13, compression space 82, the **** room 12, the second path 57, a crank case 8, and the third path 60 one by one at the time of the minimum piston stroke (state of drawing 2).

[0049] Moreover, the refrigerant gas of a crank case 8 flows to an inhalatorium 13 through orifice 58of path 60a to path 58b [of front side shaft carrier hold space 60b, path 60c of a shaft 5, 60d of rear side shaft carrier hold space, and a cylinder block 2] and valve-plate 2a of front housing 4 a. After being extracted by orifice 62a of the screw 62 which a refrigerant gas has in the middle of path 60c of a shaft 5 at this time, a rat tail and a pressure decrease again by orifice 58of valve-plate 2a a.

[0050] With this operation form, in addition, to one side of the spool type valve 31 as a **** control valve Since the thing of the spring force comparatively small as a spring 32 which adopts the structure of making the pressure of a crank case 8 acting and making the pressure of the **** room 12 acting on another side of a spool type valve 31, and energizes a spool type valve 31 in the valve-closing direction was used When a thermal load becomes small and the pressure of the **** room 12 declines gradually, a spool type valve 31 is maintained at the state where it opened until it becomes the minimum piston stroke (super-low load) and a cam plate 10 decreases the path area of the first path 58.

[0051] On the other hand, if a thermal load becomes large, a plunger 133 moves in the valve-closing direction by energization to solenoid 131A of a control valve 100, and according to the energization force of the valve-closing spring 127, the spherical valve element 126 will move in the valve-closing direction, and will close circulation of the refrigerant gas to the second path 57. Consequently, the inflow of the high-pressure refrigerant gas from the **** room 12 to a crank case 8 is prevented, and the pressure of a crank case 8 becomes low.

[0052] And the force concerning the rear side of the piston 7 in a compression stroke becomes small, and as a result of total of the force concerning the rear side of this piston 7 being less than total of the force concerning the front side of a piston 7, the degree of tilt angle of a cam plate 10 becomes large. Since boss section 10b of a cam plate 10 separates from hole 58c of a ring 9, the first path 58 is opened fully and the refrigerant gas of a crank case 8 flows to an inhalatorium through the first path 58 when the degree of tilt angle of a cam plate 10 becomes the maximum from the minimum, the fall of the pressure of a crank case 8 is promoted. If the path area of the first path 58 becomes the maximum, in an inhalatorium 13, a refrigerant gas will hardly flow from the third path 60.
[0053] Moreover, if the pressure of the **** room 12 becomes high and the pressure differential of the **** room 12 and a crank case 8 becomes beyond the predetermined value Po, the pressure of the refrigerant of the **** room 12 which acts on a spool type valve 31 will overcome resultant force with the pressure of the refrigerant gas of a crank case 8, and the energization force of a spring 32, a spool type valve 31 will move in the valve-opening direction, and the **** path 39 will open (drawing 1). Consequently, the refrigerant gas of the **** room 12 flows out of delivery 1a into a capacitor 88.
[0054] Then, operation of control valve 100 the very thing of this operation form is explained in detail. First, where solenoid 131A of a control valve 100 is excited, the aforementioned plunger 133 resists the energization force of the aforementioned spring 144, and is drawn in the aforementioned suction child 141 side, and the aforementioned spherical valve element 126 attached in this rod 132 because the rod 132 connected with the plunger 133 moves moves in the direction which closes the valve port 125 of the aforementioned control valve main part 120. On the other hand, a low-temperature refrigerant gas is led to the pressure-sensitive room 145 through the inhalation port 129 and the inhalation path 130 of the control valve main part 120 from the inhalation path 80 side which is open for free passage to an inhalatorium 13, based on the pressure of the aforementioned refrigerant gas which is the suction pressure Ps of an inhalatorium 13, the bellows 146 of the aforementioned pressure-sensitive room 145 displaces, and this displacement is transmitted to the aforementioned spherical valve element 126 through the aforementioned stem 138, the aforementioned plunger 133, and the aforementioned rod 132. At this time, the opening position to the aforementioned valve port 125 of the aforementioned spherical valve element 126 is determined by the suction force by the aforementioned solenoid 131A, the displacement force of the aforementioned bellows 146, the aforementioned valve valve-closing spring 127, and the spring 144.
[0055] Here, if the suction pressure Ps inside [pressure-sensitive room 145] the above becomes high, since the aforementioned bellows 146 will contract according to this suction pressure Ps, in accordance with the suction direction of the aforementioned plunger 133 according [this contraction direction] to the aforementioned solenoid 131A, the aforementioned spherical valve element 126 follows the variation rate of bellows 146, and the opening of the aforementioned valve port 125 decreases. The amount of the high-pressure refrigerant gas which is led to the valve chest 123 interior through a strainer 122 from the **** room 12, and is led to the crank case 8 of drawing 1 through the aforementioned port 114 and the second path 57 by this decreases (the crank case pressure Pc declines), and the degree of tilt angle of the cam plate 10 of drawing 1 increases.
[0056] Moreover, since the refrigerant gas of the inhalation path 80 side which is open for free passage to an inhalatorium 13 to low temperature is open for free passage to the suction pressure introduction space 85 prepared between the rear housing 3 and the solenoid housing 131, the whole side of the solenoid housing 131 is cooled by the refrigerant gas of the low temperature from the aforementioned inhalatorium 13 side, and the temperature rise of solenoid 131A inside [solenoid housing 131] this is stopped. On the other hand, if the suction pressure Ps inside [pressure-sensitive room 145] the above becomes low, that the aforementioned bellows 146 should be elongated by stability operation of a spring 159 and the bellows itself, and the spherical valve element 126 should follow the variation rate of bellows 146, the aforementioned spherical valve element 126 will be pressed through a stem 138, a plunger 133, and a rod 132, and this spherical valve element 126 will be moved in the direction which the

opening of the aforementioned valve port 125 increases. The amount of the high-pressure refrigerant gas which is led to the valve chest 123 interior of the above through the aforementioned strainer 122 from the **** room 12, and is led to the crank case 8 side of drawing 1 from the second path 57 of the above through the aforementioned port 114 by this increases (the crank case pressure Pc rises), and the degree of tilt angle of the cam plate 10 of drawing 1 decreases.

[0057] On the other hand, where the aforementioned solenoid 131A is demagnetized, drawing in by the side of the suction child 141 of a plunger 133 disappears, according to the energization force of the aforementioned spring 144, the aforementioned plunger 133 moves to opposite direction the aforementioned suction child 141 side, and the spherical valve element 126 is moved in the direction which opens the valve port 125 of the control valve main part 120 through a rod 132. Although displaced in the direction which the aforementioned bellows 146 will contract [direction] and will decrease the opening of the aforementioned spherical valve element 126 in this state if the suction pressure Ps inside [pressure-sensitive room 145] the above goes up, since it is equipped with the other end 140 of the aforementioned stem 138 free [attachment and detachment] to the stopper 147 of the aforementioned bellows 146, the variation rate of the aforementioned bellows 146 is not influenced to the aforementioned spherical valve element 126.

[0058] Consequently, the spherical valve element 126 is held in the maximum opening position, without being influenced by the suction pressure Ps of the pressure-sensitive room 145 interior of a rise. moreover, the maximum of bellows 146 -- a variation rate -- since the amount is set up so that it may become smaller than the amount of the maximum fitting of the other end 140 of the aforementioned stem 138, and the stopper 147 of the aforementioned bellows 146, the other end 140 of this stem 138 does not secede from the stopper 147 of this bellows 146

[0059] Thus, when, as for the control valve 100 of this operation form, the aforementioned low-temperature refrigerant gas is introduced from an inhalatorium 13 in the pressure-sensitive room 145 of the aforementioned control valve main part 120, This low-temperature refrigerant gas is led to the low-temperature refrigerant-gas introduction space 85 in which it is prepared between the aforementioned solenoid housing 131 and the aforementioned rear housing 3. Since the whole side of this solenoid housing 131 was cooled by this low-temperature refrigerant gas, the fall of the excitation force by solenoid 131A inside [solenoid housing 131] the above can be suppressed.

[0060] Moreover, since the aforementioned pressure-sensitive room 145 is equipped with the stretching screw electrode holder 152 which has the stretching screw 153 which adjusts the strength of bellows 146 in the state of sealing and the aforementioned stretching screw 153 adjusted the strength of the bellows 146 inside [pressure-sensitive room 145] the above from the exterior of the aforementioned control valve main part 120, the strength of the bellows 146 of the pressure-sensitive room 145 interior can be easily adjusted to a control valve 100. Furthermore, since the aforementioned control valve main part 120 was laid under the rear housing 210 side of the aforementioned variable-capacity type compressor 200 where the aforementioned stretching screw electrode holder 152 is turned outside, even if it is in the state which equipped the rear housing 210 with the control valve main part 120, the strength of the bellows 146 inside [pressure-sensitive room 145] the above can be easily adjusted from the outside.

[0061] Furthermore, since it arranged in the interior of solenoid 131A which draws the aforementioned stem 138 which accomplishes a part of aforementioned operation lever in the direction in which the aforementioned opening by the aforementioned spherical valve element 126 decreases and the point of application by suction of this solenoid 131A to an operation lever and the point of application of the energization force by the aforementioned bellows 146 brought close near the aforementioned pressure-sensitive room 145 again, it is stopped with [of the operation lever at the time of movement in the direction of valve-closing of an operation lever] backlash Moreover, since it is a globular form-like, even if the aforementioned spherical valve element 126 is the case where an inclination arises to the aforementioned rod 132 at the time of a valve-closing operation, it can make the aforementioned spherical valve element 126 contact

equally to a valve port 125.
[0062] As mentioned above, although this operation form showed the case where a stretching screw 153 and the stretching screw electrode holder 152 were used as another object, this invention of the ability of the cap 152a structure which shows the important section and which unified the stretching screw and the stretching screw electrode holder like other operation forms to be used not only for the above composition but for drawing 5 is natural. This cap 152a has secured the airtight with O ring 154 while it screws adjustment male screw section 152b engraved on the periphery of the aforementioned cap 152a in adjustment female screw section 157a engraved on the inner circumference of a plate 157 and makes centering control free.
[0063]
[Effect of the Invention] According to the control valve for variable-capacity type compressors concerning this invention, so that I may be understood from the above explanation When a low-temperature refrigerant gas is introduced into the pressure-sensitive interior of a room of a control valve main part, this low-temperature refrigerant gas is led to the low-temperature refrigerant-gas introduction space in which it is prepared between the aforementioned solenoid housing and the aforementioned rear housing. The whole side of this solenoid housing can be cooled by this low-temperature refrigerant gas, and the fall of the excitation force by the solenoid inside this solenoid housing can be suppressed.
[0064] Moreover, the end of a stem is fixed to the end of the plunger of the aforementioned solenoid. The stopper of the bellows arranged in the aforementioned pressure-sensitive room at the other end of this stem enables contact arrangement of the attachment and detachment. Since the spring which carries out connection fixation of the rod which contacts the other end of the aforementioned plunger at the aforementioned valve element, and energizes this plunger at the end of the plunger of the aforementioned solenoid at the aforementioned valve element side was arranged When the aforementioned plunger is not excited by the solenoid, the aforementioned valve element can always be changed into the state of the maximum opening position, without being influenced by operation of the bellows of the aforementioned pressure-sensitive interior of a room.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the control valve for variable-capacity type compressors used for air conditioners, such as vehicles, and relates to the control valve for variable-capacity type compressors which controls supply of the refrigerant gas from a discharge-pressure field to into a crank case especially if needed.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] From the former, the variable-capacity type compressor equipped with the cylinder, the piston, the cam plate, etc. is used in order to compress and carry out the regurgitation of the refrigerant gas of the conditioner for automobiles, and what was constituted so that the degree of tilt angle of a cam plate might be changed and discharging volume might be changed is known by equipping this variable-capacity type compressor with the refrigerant gas passageway which opens a discharge-pressure field and a crank case for free passage, and adjusting the pressure in the aforementioned crank case. Pressure regulation in a crank case is performed by opening adjustment of the control valve prepared in the middle of the aforementioned refrigerant gas passageway by supplying a high-pressure compression refrigerant gas to the aforementioned crank case from the aforementioned discharge-pressure field.
[0003] As such a control valve, there is control valve 100' for variable-capacity type compressors (only henceforth a control valve) as shown in drawing 6 and drawing 7 , for example (refer to JP,9-268974,A). This control valve 100' is prepared in the rear housing 210 side of the variable-capacity type compressor 200, and performs pressure regulation of the crank case 231 in the front housing 230 it is connected [front / cylinder block / of the variable-capacity type compressor 200 / 220].
[0004] Here, while the cam plate 240 as a cam plate is supported by the crank case 231 interior possible [a slide in the direction of an axis of the drive shaft 250], and possible [****], the guide pin 241 of a cam plate 240 is supported by it free [a slide on the support arm 252 of the rotation base material 251]. Moreover, the cam plate 240 is connected with the piston 260 currently arranged free [sliding] in the cylinder bore 221 through the shoe 242 of the couple of this cam plate 240.
[0005] And according to the difference of the suction pressure Ps in a cylinder bore 221, and the crank case pressure Pc in the aforementioned crank case 231, the aforementioned cam plate 240 performs rotation operation in the direction of an arrow, and changes the degree of tilt angle. Based on this degree of tilt angle, the stroke width of the longitudinal slide movement within the cylinder bore 221 of a piston 260 is determined. moreover, the interception object 270 which is in contact with the mountain side section of a cam plate 240 with rotation operation to the direction of an arrow of a cam plate 240 -- hold -- longitudinal slide movement of the inside of a hole 222 is carried out
[0006] Furthermore, partition formation of the **** rooms 212a and 212b which constitute Inhalatoriums 211a and 211b and the discharge-pressure field which constitute an inlet-pressure field in the aforementioned rear housing 210 is carried out. In a piston 260 operating approximately based on rotation of the aforementioned cam plate 240, after the refrigerant gas in inhalatorium 211a is compressed until it was inhaled in the cylinder bore 221 from the inhalation port 213 and reached the predetermined pressure after that, it is breathed out by **** room 212a from the **** port 214.
[0007] furthermore, the inhalation path 215 formed in a part for the core of the rear housing 210 again -- the aforementioned hold -- while it is open for free passage to a hole 222, it is open for free passage to the aforementioned inhalatorium 211b through a through-hole 216 And when a cam plate 240 moves to the interception object 270 side, for example, the interception object

270 moves to the aforementioned inhalation path 215 side, and closes a through-hole 216 with the interception object 270 soon.
[0008] Moreover, between the aforementioned inhalation path 215 and the upper-limit section side of aforementioned control valve 100', the pressure-taking path 217 for drawing suction pressure Ps in this control valve 100' is formed. Furthermore, while the aforementioned **** room 212b and the aforementioned crank case 231 are opened for free passage through the air-supply path 218 and the air-supply path 219 of control valve 100', these air-supply paths 218 and the air-supply path 219 are opened and closed by valve element 106of control valve 100' '. Here, the discharge pressure Pd of **** room 212b is led to valve chest port 113' through the air-supply path 218, and the aforementioned crank case internal pressure Pc is led to port 114' through the air-supply path 219. Furthermore, the aforementioned suction pressure Ps is led to inlet-pressure introduction port 115' through the aforementioned pressure-taking path 217.
[0009] And when [for example,] an air conditioner is operation switched [280] off and the detection temperature obtained from the indoor sensor 281 is more than the setting temperature of the room temperature setter 282, If a control computer 283 orders it excitation of solenoid 101' of aforementioned control valve 100' and predetermined current is supplied through the drive circuit 284, with the suction force by this solenoid 101' Movable iron core 102' resists the energization force of spring 103', and can draw near to a fixed iron core 104' side.
[0010] With movement of this movable iron core 102', valve element 106' attached in solenoid rod 105' resists the energization force of compulsive opening spring 107', and moves the degree of valve-opening of valve port 108' to the side which decreases. Bellows 111' connected with this valve element 106' free [attachment and detachment] through pressure-sensitive rod receptacle section 110' because pressure-sensitive rod 109' prepared in one goes up is forced with movement of valve element 106'.
[0011] At this time, this bellows 111' is displaced according to change of the suction pressure Ps introduced in pressure-sensitive room 112' through the pressure-taking path 217, and gives a load to aforementioned pressure-sensitive rod 109'. That is, the degree of valve-opening of aforementioned valve port 108' by aforementioned valve element 106' is determined by the balance of the suction force according [control valve 100'] to aforementioned solenoid 101', the energization force from aforementioned bellows 111', and the energization force of aforementioned forcible opening spring 107'.
[0012] Here, when the difference of the detection temperature of the aforementioned indoor sensor 281 and the setting temperature of the room temperature setter 282 is large when a cooling load is large namely, the suction force between movable iron core 102' and fixed iron core 104' is strengthened, and opening and closing of aforementioned valve element 106' are performed by that the energization force to the direction where the degree of valve-opening of valve port 108' by aforementioned valve element 106' decreases increases by the lower suction pressure Ps.
[0013] If the degree of valve-opening by this valve element 106' becomes small, the refrigerant capacity through the air-supply path 218 and the air-supply path 219 from aforementioned **** room 212b to the aforementioned crank case 231 will decrease, and the crank case pressure Pc in the aforementioned crank case 231 will also become low. Moreover, when the aforementioned cooling load is large, the suction pressure Ps in the aforementioned cylinder bore 221 is high, a difference arises to the suction pressure Ps in this cylinder bore 221, and the crank case pressure Pc in the aforementioned crank case 231, the degree of tilt angle of the aforementioned cam plate 240 is large, by the bird clapper, the aforementioned interception object 270 separates from the aforementioned inhalation path 215 side, and a path 216 is opened.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] It leads to the low-temperature refrigerant-gas introduction space in which this low-temperature refrigerant gas is prepared between the aforementioned solenoid housing and the aforementioned rear housing when a low-temperature refrigerant gas is introduced into the pressure-sensitive interior of a room of a control valve main part according to the control valve for variable-capacity type compressors concerning this invention so that I may be understood from the above explanation, and is this low-temperature refrigerant gas about the whole side of this solenoid housing. It can cool and the fall of the excitation force by the solenoid inside this solenoid housing can be suppressed.
[0064] moreover -- since the spring which fixes the end of a stem to the end of the plunger of the aforementioned solenoid, the stopper of the bellows arranged in the aforementioned pressure-sensitive room at the other end of this stem enables contact arrangement of the attachment and detachment, carries out connection fixation of the rod which contacts the other end of the aforementioned plunger at the aforementioned valve element, and energizes this plunger at the end of the plunger of the aforementioned solenoid at the aforementioned valve element side was arranged When the aforementioned plunger is not excited by the solenoid, the aforementioned valve element can always be changed into the state of the maximum opening position, without being influenced by operation of the bellows of the aforementioned pressure-sensitive interior of a room.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in conventional control valve 100' which was mentioned above, as shown in drawing 7 , a discharge pressure Pd is led to valve chest port 113of control valve 100' ' through the aforementioned air-supply path 218. This discharge pressure Pd is high pressure, and in order to release high temperature by being compressed until the refrigerant gas which moreover brings about a discharge pressure Pd reaches a predetermined pressure by operation before and after the aforementioned piston 260, aforementioned control valve 100' itself will become an elevated temperature according to this high temperature.

[0015] Thus, when control valve 100' itself becomes an elevated temperature, since the temperature of solenoid 101' also rises, there is a problem that the suction force of aforementioned movable iron core 102' by this solenoid 101' will decline, and the opening-and-closing precision of aforementioned valve port 108' by aforementioned valve element 106' will fall. Moreover, in conventional control valve 100', since the space which needs to incorporate aforementioned bellows 111' in pressure-sensitive room 112' where the aforementioned interior of pressure-sensitive room 112' is considered as sealing, and inserts an adjustment fixture etc. from the exterior cannot be provided, it is impossible to adjust the load force of aforementioned bellows 111'.

[0016] Furthermore, since it is in the state where the point of application of suction to solenoid rod 105' by aforementioned solenoid 101' and the point of application of the energization force by aforementioned bellows 111' separated, Since the point of aforementioned valve element 106' which blockades about [that there is a possibility that it may be generated with backlash in this solenoid rod 105'], and aforementioned valve port 108' is only made into the flat configuration at the time of movement of aforementioned solenoid rod 105' at the time of valve closing, It is hindrance when a possibility that aforementioned valve element 106' may contact aforementioned valve port 108' unequally also raises valve-opening close precision with [aforementioned] backlash for a certain reason. While this invention is made in view of such a trouble and the purpose raises valve-opening close precision, it is offering the control valve for variable-capacity type compressors which can adjust the load force of bellows easily.

[Translation done.]

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MEANS

[Means for Solving the Problem] The control valve for variable-capacity type compressors concerning this invention that the aforementioned purpose should be attained An excitation operation of the solenoid inside solenoid housing in which it is prepared by the control valve main part adjusts the opening of the valve element arranged at the refrigerant gas passageway which opens the discharge-pressure field and crank case of this variable-capacity type compressor for free passage. While changing the discharging volume of the aforementioned compressor and laying the aforementioned control valve main part under the rear housing side of the aforementioned variable-capacity type compressor by changing the degree of tilt angle of the cam plate in the aforementioned crank case It is characterized by preparing the low-temperature refrigerant-gas introduction space which is open for free passage to the inlet-pressure field of the aforementioned variable-capacity type compressor between the aforementioned solenoid housing and the aforementioned rear housing.
[0018] The control valve for variable-capacity type compressors concerning this invention constituted like the above While a low-temperature refrigerant gas is introduced into the pressure-sensitive interior of a room of a control valve main part from the aforementioned inhalation field Since this low-temperature refrigerant gas is led also to the low-temperature refrigerant-gas introduction space prepared between the aforementioned solenoid housing and the aforementioned rear housing and makes the whole side of this solenoid housing cool by this hot-cold intermediation gas The fall of the excitation force of the solenoid inside housing based on heat etc. can be suppressed.
[0019] Moreover, the pressure-sensitive room which is open for free passage in the inlet-pressure field of a variable-capacity type compressor on the aforementioned control valve main part, The bellows made to move the aforementioned valve element in the direction in which the opening decreases when it holds in this pressure-sensitive interior of a room and the pressure of the aforementioned inlet-pressure field rises, The strength of the bellows of this pressure-sensitive indoor section can be adjusted easily, maintaining the sealing state of the aforementioned pressure-sensitive indoor section, since the stretching screw electrode holder with the stretching screw which is connected [room / pressure-sensitive / aforementioned] by the sealing state, and adjusts the strength of the aforementioned bellows was provided.
[0020] Furthermore, by laying the aforementioned control valve main part under the rear housing side of the aforementioned variable-capacity type compressor, where the aforementioned stretching screw electrode holder is turned outside, even if it is in the state which equipped this rear housing with this control valve main part, the strength of the bellows of the aforementioned pressure-sensitive indoor section can be easily adjusted from the outside.
[0021] Furthermore, the pressure-sensitive room where the aforementioned control valve main part arranged the solenoid in the center section, and arranged bellows in the end section again, And arrange the valve chest which arranged the aforementioned valve element in the other end, and the end of a stem is fixed to the end of the plunger of the aforementioned solenoid. The stopper of the bellows arranged in the aforementioned pressure-sensitive room at the other end of this stem enables contact arrangement of the attachment and detachment. Since the spring which carries out connection fixation of the rod which contacts the other end of the

aforementioned plunger at the aforementioned valve element, and energizes this plunger at the end of the plunger of the aforementioned solenoid at the aforementioned valve element side was arranged When the aforementioned plunger is not excited by the solenoid, the aforementioned valve element can always be changed into the state of the maximum opening position, without being influenced by operation of the bellows of the aforementioned pressure-sensitive interior of a room.

[0022] Moreover, it is stopped with [of this operation lever at the time of movement in the direction of valve-closing of the aforementioned rod or a stem which constitutes an operation lever from the point of application by suction of this solenoid and the point of application by the aforementioned bellows having been close brought by having carried out approach arrangement of the aforementioned pressure-sensitive room and the solenoid] backlash by necessary minimum. Moreover, even if it is the case where an inclination arises for the aforementioned operation lever at the time of a valve-closing operation, the aforementioned valve element can be made to contact equally to a valve port by making the aforementioned valve element into the shape of a globular form.

[0023]

[Embodiments of the Invention] Hereafter, a drawing explains the form of 1 operation of the control valve for variable-capacity type compressors of this invention. Drawing of longitudinal section and drawing 2 which drawing 1 and drawing 2 show the variable-capacity type compressor 1 equipped with the control valve 100 of this operation form, and show the state where the **** path of this variable-capacity type compressor 1 opened drawing 1 are drawing of longitudinal section showing the state where the **** path closed. The front housing 4 is being fixed to the other end side for the rear housing 3 through valve-plate 2a by the end side of the cylinder block 2 of the variable-capacity type compressor 1, respectively. Two or more cylinder bores 6 are arranged in the hoop direction every predetermined interval focusing on the shaft (axis of rotation) 5 by the cylinder block 2. In these cylinder bores 6, the piston 7 is held possible [sliding], respectively.

[0024] A crank case 8 is formed in the front housing 4, and the cam plate 10 is contained in this crank case 8. The shoe 50 supported possible [relative rolling of end section 11a of the shape of a sphere of a connecting rod 11] is held by the retainer 53 at sliding-surface 10a of this cam plate 10. Boss section 10b of a cam plate 10 is equipped with a retainer 53 through radial bearing 55, and relative rotation is possible for it to a cam plate 10. Radial bearing 55 is escaped from, stopped and carried out by the stopper 54 which ****ed to boss section 10b and was fixed by 45.

[0025] The shoe 50 consists of a main part 51 of a shoe supported possible [relative rolling of the apical surface of end section 11a of a connecting rod 11], and a washer 52 supported possible [relative rolling of the back end side of end section 11a of a connecting rod 11]. The **** room 12 and the inhalatorium 13 are formed in the rear housing 3. This inhalatorium 13 is arranged so that the **** room 12 may be surrounded. The inhalation mouth (illustration abbreviation) which leads to the outlet of an evaporator (illustration abbreviation) is prepared in the aforementioned rear housing 3. Drawing 1 shows the state where the **** path 39 opened, and drawing 2 shows the state where this **** path 39 closed. It consists of path 39b formed in path 39a by which the spool type valve (**** control valve) 31 is formed in the middle of, and the **** path 39 was formed in the rear housing 3 and valve-plate 2a. [the **** path 39 which makes the aforementioned **** room 12 and delivery 1a open for free passage] Path 39b leads to delivery 1a formed in the cylinder block 2.

[0026] The spring (energization member) 32 was held in the cylinder-like-object-with-base-like spool type valve 31, the end of a spring 32 contacted the stopper 56 fixed to the aforementioned rear housing 3 with the cap 59, and the other end of the aforementioned spring 32 is in contact with the base of a spool type valve 31. The building envelope 33 of this spool type valve 31 is open for free passage to the crank case 8 through a path 34.

[0027] The energization force of a spring 32 and the pressure of a crank case 8 act on one side (above) of the aforementioned spool type valve 31 in the valve-closing direction (direction where the degree of valve-opening becomes small). Delivery 1a and the regurgitation room 12 are open

for free passage through the regurgitation path 39 at the time of valve opening of the aforementioned spool type valve 31 (refer to drawing 1). Therefore, in another side of a spool type valve 31, the pressure of delivery 1a and the pressure of the regurgitation room 12 act in the valve-opening direction (direction where the degree of valve-opening becomes large). However, when the pressure differential of a crank case 8 and delivery 1a becomes below a predetermined value, a spool type valve 31 moves in the valve-closing direction, the regurgitation path 39 is intercepted, and only the pressure of the regurgitation room 12 acts on the spool-type-valve 31 bottom in the valve-opening direction. The pressure of delivery 1a stops namely, acting on the spool-type-valve 31 bottom.

[0028] The regurgitation room 12 and a crank case 8 are open for free passage through the s cond path 57. In the middle of the path 57, the control valve (control valve for variable-capacity type compressors) 100 of this operation gestalt which mentions a detail later is formed. When a thermal load is large, a valve element 126 sits down by energization to solenoid 131A of this control valve 100, the second path 57 is intercepted, when a thermal load is small, a valve element 126 separates from a valve seat by energization halt to solenoid 131A, and the second path 57 is released. The operation of the aforementioned control valve 100 is controlled by the computer which is not illustrated.

[0029] The aforementioned inhalatorium 13 and a crank case 8 are open for free passage through the first path 58. the hole formed in orifice (second orifice) 58a by which this path 58 was formed in valve-plate 2a, path 58b formed in the cylinder block 2, and the ring (annular solid) 9 fixed to the shaft 5 -- it consists of 58c The inhalatorium 13 and the crank case 8 are open for free passage through the third path 60. This path 60 consists of path 60a formed in the front housing 4, front side shaft carrier hold space 60b, path 60c formed in the shaft 5, 60d of rear side shaft carrier hold space formed in the cylinder block 2 and path 58b of a cylinder block 2, and orifice 58of valve-plate 2a a. Path 58b of a cylinder block 2 and orifice 58of valve-plate 2a a constitute a part of third path 60 while constituting a part of first path 58 of the above.

[0030] A female screw 61 is formed in the inner skin of the rear side edge section of the aforementioned path 60c, and the screw 62 is thrust into this female screw 61. Orifice (first orifice) 62a is formed in this screw 62, and the path area of this orifice 62a is smaller than the path area of second orifice 58a of valve-plate 2a which constitutes a part of first path 58 of the above on it. therefore, boss section 10b of a cam plate 10 -- the hole of a ring 9 -- only when 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the refrigerant of a crank case 8 is led to an inhalatorium 13 through the third path 60

[0031] The inhalation port 15 which makes aforementioned valve-plate 2a open for free passage **** POTO 16 which makes compression space 82 and the **** room 12 open for free passage, and compression space 82 and an inhalatorium 13 is established in the hoop direction every predetermined interval, respectively. The **** port 16 is opened and closed by the discharge valve 17, and this discharge valve 17 is being fixed to the rear housing side edge side of valve-plate 2a with the bolt 19 and the nut 20 with the valve guard 18. Moreover, the inhalation port 15 is opened and closed by the suction valve portion 21, and the suction valve portion 21 is arranged between valve-plate 2a and the cylinder block 2.

[0032] The rear side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (rear side shaft carrier) 24 and thrust bearing (rear side shaft carrier) 25 which were contained by 60d of rear side shaft carrier receipt space of a cylinder block 2, and the front side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (front side shaft carrier) 26 held in front side shaft carrier hold space 60b of the front housing 4. The shaft seal 46 other than radial bearing 26 is held in bearing receipt space 60b by the side of a front.

[0033] Female screw 1b is prepared in the center section of the cylinder block 2, and the adjust nut 83 is screwing in this female screw 1b. By fastening this adjust nut 83, preloading is given to a shaft 5 through thrust bearing 25. Moreover, a pulley (illustration abbreviation) is fixed to the front side edge section of a shaft 5. The thrust flange 40 for transmitting rotation of a shaft 5 to a cam plate 10 is fixed to a shaft 5, and this thrust flange 40 is supported by the internal surface of the front housing 4 through thrust bearing 33. The thrust flange 40 and a cam plate 10 are connected through the hinge mechanism 41, and a cam plate 10 can incline to a shaft 5 and a

right-angled virtual side. The shaft 5 is equipped with the cam plate 10 possible [sliding and an inclination].

[0034] The hinge mechanism 41 is with 10f of linear guide slots established in bracket 10e prepared in front side 10c of a cam plate 10, and this bracket 10e, and the rod 43 screwed in cam-plate side side 40a of the thrust flange 40, and is constituted. The longitudinal shaft of 10f of guide slots leans the degree of predetermined angle to front side 10c of a cam plate 10. Spherical section 43a of a rod 43 has fitted into the 10f of the aforementioned guide slots possible [relative sliding].

[0035] Next, control valve (only henceforth control valve) 100 the very thing for variable-capacity type compressors of this operation form is explained in detail. Drawing of longitudinal section showing the state where drawing 3 included the control valve 100 in the variable-capacity type compressor 1, and drawing 4 are the cross sections showing the detail of the control valve of drawing 3 . The control valve 100 shown in drawing 3 is formed in the rear housing 3 side of aforementioned drawing 1 and the variable-capacity type compressor 1 of drawing 2 , and the control valve main part 120 of a control valve 100 is arranged where airtightness is maintained at the space 84 opened for free passage by the aforementioned **** room 12 of the discharge pressure Pd of a refrigerant through O rings 121a and 121b. In the edge of the control valve main part 120, attachment fixation of the strainer 122 is carried out, and the refrigerant gas which brings the high-pressure discharge pressure Pd to the valve chest of the control valve main part 120 interior 123 interior through this strainer 122 is incorporated.

[0036] While the spherical valve element 126 which performs opening and closing of a stopper 124 and a valve port 125 is arranged in the valve chest 123 interior, between these stoppers 124 and the spherical valve element 126, the valve-closing spring 127 which energizes this spherical valve element 126 in the direction of valve-closing intervenes. Moreover, the port 114 where the crank case pressure Pc of this crank case 8 is led to the aforementioned control valve main part 120 while it is open for free passage through the aforementioned path 57 to the crank case 8 of drawing 1 is formed, and the high-pressure refrigerant gas led to the valve chest 123 interior of the above by opening of the aforementioned valve port 125 by the aforementioned spherical valve element 126 through the aforementioned strainer 122 is led to the aforementioned crank case 8 side from this port 114 and the aforementioned path 57.

[0037] Furthermore, while it is open for free passage to an inhalatorium 13 through the path 80 of drawing 1 , the inhalation port 129 to which the suction pressure Ps of this inhalatorium 13 is led is established in the aforementioned control valve main part 120. Moreover, this inhalation port 129 is open for free passage to the suction pressure introduction space 85 prepared between the aforementioned rear housing 3 and the solenoid housing 131 while being drawn in the pressure-sensitive room 145 later mentioned through the inhalation path 130. Furthermore, this suction pressure introduction space 85 is sealed through O ring 131b of projected part 131a prepared in the flank of the solenoid housing 131. By forming the suction pressure introduction space 85, the whole side of the solenoid housing 131 is cooled by the refrigerant gas of the low temperature from the aforementioned inhalatorium 13 side, and the temperature rise of solenoid 131A of the solenoid housing 131 interior is stopped.

[0038] The plunger 133 by which connection fixation is carried out is arranged in the solenoid housing 131 interior by the rod 132 which contacts and carries out support fixation of the aforementioned spherical valve element 126. Moreover, this plunger 133 is supported free [sliding] with the pipe 136 attached in the pipe electrode holder 135 which touches a close state through O ring 134 to edge 120a of the aforementioned control valve main part 120. In addition, the aforementioned rod 132 constitutes the operation lever with the stem 138 mentioned later.

[0039] the hold currently formed in back end section 133a of a plunger 133 -- while insertion fixation of the end section 139 of a stem 138 is carried out at the hole 137 -- the other end 140 of the aforementioned stem 138 -- hold of the suction child 141 -- the hold from a hole 142 side -- it is in the state projected to a hole 143 side, and is supported free [sliding] to the suction child 141 the hold by the side of the aforementioned plunger 133 -- the hold by the side of a hole 137 and the aforementioned suction child 141 -- between holes 142, the spring 144

energized in the direction which separates a plunger 133 from the suction child 141 side intervenes

[0040] Moreover, the other end 140 of a stem 138 is equipped with this stopper 147 side free [attachment and detachment] among the stoppers 147,148 of the couple of the bellows 146 interior currently arranged in the pressure-sensitive room 145. the flange 149 of this stopper 147, and the hold by the side of the aforementioned suction child 141 -- between holes 143, the spring 150 energized in the direction which separates a stopper 147 from the suction child 141 side intervenes

[0041] And the suction pressure Ps in the pressure-sensitive room 145 becomes high, and when stopper 147,148 comrades of a couple contact by contraction of bellows 146, the maximum serious grade position of bellows 146 is regulated. moreover, the maximum of bellows 146 -- a variation rate -- since the amount is set up so that it may become smaller than the amount of the maximum fitting of the other end 140 of the aforementioned stem 138, and the stopper 147 of bellows 146, the other end 140 of the aforementioned stem 138 does not secede from the stopper 147 of the aforementioned bellows 146

[0042] Furthermore, while forming the aforementioned pressure-sensitive room 145, attachment fixation of the stretching screw electrode holder 152 is carried out at the pipe 151 by which adhesion maintenance is carried out through O ring 156 at the plate 157. While the stretching screw 153 which adjusts the strength of the aforementioned bellows 146 to the stretching screw electrode-holder 152 interior of this is formed in the close state through O ring 154, the edge 155 of a stretching screw 153 is in contact with the stopper 148 of the aforementioned bellows 146. Furthermore, the code 158 in which the predetermined exciting current controlled by the aforementioned control computer (illustration abbreviation) is supplied is connected to the aforementioned solenoid 131A side again.

[0043] Next, an operation with the variable-capacity type compressor 1 of this operation form and a control valve 100 is explained. The operation of the whole variable-capacity type compressor 1 is explained previously, and, subsequently the operation of a control valve 100 is explained. The rotational-motion force of a mounted engine is always transmitted to the aforementioned shaft 5 from the pulley which is not illustrated through the belt which is not illustrated, the turning effort of a shaft 5 is transmitted to a cam plate 10 through the thrust flange 40 and the hinge mechanism 41, and this cam plate 10 rotates it.

[0044] Since a shoe 50 carries out relative rotation of the sliding-surface 10a top of a cam plate 10 by rotation of a cam plate 10, the turning effort from a cam plate 10 is changed into straight-line reciprocating movement of a piston 7. This piston 7 moves the inside of a cylinder bore 6 reciprocately, as a result, the capacity of the compression space 82 in a cylinder bore 6 changes, inhalation of a refrigerant gas, compression, and **** are performed one by one by this capacity change, and the refrigerant gas of capacity according to the degree of tilt angle of a cam plate 10 is breathed out. At the time of inhalation, a suction valve portion 21 opens and a low-pressure refrigerant gas is breathed out from an inhalatorium 13 to the compression space 82 in a cylinder bore 6.

[0045] If a thermal load becomes small (at the time of the clutch-off equivalent of a compressor with a clutch), the energization to the solenoid of a control valve 100 is stopped, and a control valve 100 (plunger 133) moves in the open direction, and the spherical valve element 126 of this control valve 100 will resist the energization force of the valve-closing spring 127, it will move in the valve-opening direction, and the second path 57 will open. Consequently, a high-pressure refrigerant gas flows out of the **** room 12 into a crank case 8 through the second path 57, and the pressure of this crank case 8 becomes high.

[0046] And the force concerning the rear side of the piston 7 in a compression stroke becomes large, and as a result of total of the force concerning the rear side of a piston 7 exceeding total of the force concerning the front side (top side) of a piston 7, the degree of tilt angle of a cam plate 10 becomes small. the time of the degree of tilt angle of a cam plate 10 becoming the minimum -- boss section 10b of a cam plate 10 -- the hole of a ring 9 -- since 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the failure of pressure of a crank case 8 is suppressed

[0047] The pressure differential of the aforementioned **** room 12 and a crank case 8 becomes below the predetermined value Po, and if resultant force with the pressure of a crank case 8 and the energization force of a spring 32 of acting on the spool-type-valve 31 bottom overcomes the pressure of the refrigerant gas of the **** room 12 which acts on the spool-type-valve 31 bottom, the aforementioned spool type valve 31 will move in the valve-closing direction, and will intercept the **** path 39 (drawing 2). Consequently, the outflow of the refrigerant gas from delivery 1a to a capacitor 88 is prevented. this time -- above -- boss section 10b of a cam plate 10 -- the hole of a ring 9 -- although 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the refrigerant gas in a crank case 8 flows to an inhalatorium 13 through the third path 60 While the overpressure rise of a crank case 8 is suppressed by this, circulation within the compressor 1 of a refrigerant gas is attained.
[0048] A refrigerant gas returns to an inhalatorium 13 again through an inhalatorium 13, compression space 82, the **** room 12, the second path 57, a crank case 8, and the third path 60 one by one at the time of the minimum piston stroke (state of drawing 2).
[0049] Moreover, the refrigerant gas of a crank case 8 flows to an inhalatorium 13 through orifice 58of path 60a to path 58b [of front side shaft carrier hold space 60b, path 60c of a shaft 5, 60d of rear side shaft carrier hold space, and a cylinder block 2] and valve-plate 2a of front housing 4 a. After being extracted by orifice 62a of the screw 62 which a refrigerant gas has in the middle of path 60c of a shaft 5 at this time, a rat tail and a pressure decrease again by orifice 58of valve-plate 2a a.
[0050] With this operation form, in addition, to one side of the spool type valve 31 as a **** control valve Since the thing of the spring force comparatively small as a spring 32 which adopts the structure of making the pressure of a crank case 8 acting and making the pressure of the **** room 12 acting on another side of a spool type valve 31, and energizes a spool type valve 31 in the valve-closing direction was used When a thermal load becomes small and the pressure of the **** room 12 declines gradually, a spool type valve 31 is maintained at the state where it opened until it becomes the minimum piston stroke (super-low load) and a cam plate 10 decreases the path area of the first path 58.
[0051] On the other hand, if a thermal load becomes large, a plunger 133 moves in the valve-closing direction by energization to solenoid 131A of a control valve 100, and according to the energization force of the valve-closing spring 127, the spherical valve element 126 will move in the valve-closing direction, and will close circulation of the refrigerant gas to the second path 57. Consequently, the inflow of the high-pressure refrigerant gas from the **** room 12 to a crank case 8 is prevented, and the pressure of a crank case 8 becomes low.
[0052] And the force concerning the rear side of the piston 7 in a compression stroke becomes small, and as a result of total of the force concerning the rear side of this piston 7 being less than total of the force concerning the front side of a piston 7, the degree of tilt angle of a cam plate 10 becomes large. Since boss section 10b of a cam plate 10 separates from hole 58c of a ring 9, the first path 58 is opened fully and the refrigerant gas of a crank case 8 flows to an inhalatorium through the first path 58 when the degree of tilt angle of a cam plate 10 becomes the maximum from the minimum, the fall of the pressure of a crank case 8 is promoted. If the path area of the first path 58 becomes the maximum, in an inhalatorium 13, a refrigerant gas will hardly flow from the third path 60.
[0053] Moreover, if the pressure of the **** room 12 becomes high and the pressure differential of the **** room 12 and a crank case 8 becomes beyond the predetermined value Po, the pressure of the refrigerant of the **** room 12 which acts on a spool type valve 31 will overcome resultant force with the pressure of the refrigerant gas of a crank case 8, and the energization force of a spring 32, a spool type valve 31 will move in the valve-opening direction, and the **** path 39 will open (drawing 1). Consequently, the refrigerant gas of the **** room 12 flows out of delivery 1a into a capacitor 88.
[0054] Then, operation of control valve 100 the very thing of this operation form is explained in detail. First, where solenoid 131A of a control valve 100 is excited, the aforementioned plunger 133 resists the energization force of the aforementioned spring 144, and is drawn in the aforementioned suction child 141 side, and the aforementioned spherical valve element 126

attached in this rod 132 because the rod 132 connected with the plunger 133 moves moves in the direction which closes the valve port 125 of the aforementioned control valve main part 120. On the other hand, a low-temperature refrigerant gas is led to the pressure-sensitive room 145 through the inhalation port 129 and the inhalation path 130 of the control valve main part 120 from the inhalation path 80 side which is open for free passage to an inhalatorium 13, based on the pressure of the aforementioned refrigerant gas which is the suction pressure Ps of an inhalatorium 13, the bellows 146 of the aforementioned pressure-sensitive room 145 displaces, and this displacement is transmitted to the aforementioned spherical valve element 126 through the aforementioned stem 138, the aforementioned plunger 133, and the aforementioned rod 132. At this time, the opening position to the aforementioned valve port 125 of the aforementioned spherical valve element 126 is determined by the suction force by the aforementioned solenoid 131A, the displacement force of the aforementioned bellows 146, the aforementioned valve valve-closing spring 127, and the spring 144.

[0055] Here, if the suction pressure Ps inside [pressure-sensitive room 145] the above becomes high, since the aforementioned bellows 146 will contract according to this suction pressure Ps, in accordance with the suction direction of the aforementioned plunger 133 according [this contraction direction] to the aforementioned solenoid 131A, the aforementioned spherical valve element 126 follows the variation rate of bellows 146, and the opening of the aforementioned valve port 125 decreases. The amount of the high-pressure refrigerant gas which is led to the valve chest 123 interior through a strainer 122 from the **** room 12, and is led to the crank case 8 of drawing 1 through the aforementioned port 114 and the second path 57 by this decreases (the crank case pressure Pc declines), and the degree of tilt angle of the cam plate 10 of drawing 1 increases.

[0056] Moreover, since the refrigerant gas of the inhalation path 80 side which is open for free passage to an inhalatorium 13 to low temperature is open for free passage to the suction pressure introduction space 85 prepared between the rear housing 3 and the solenoid housing 131, the whole side of the solenoid housing 131 is cooled by the refrigerant gas of the low temperature from the aforementioned inhalatorium 13 side, and the temperature rise of solenoid 131A inside [solenoid housing 131] this is stopped. On the other hand, if the suction pressure Ps inside [pressure-sensitive room 145] the above becomes low, that the aforementioned bellows 146 should be elongated by stability operation of a spring 159 and the bellows itself, and the spherical valve element 126 should follow the variation rate of bellows 146, the aforementioned spherical valve element 126 will be pressed through a stem 138, a plunger 133, and a rod 132, and this spherical valve element 126 will be moved in the direction which the opening of the aforementioned valve port 125 increases. The amount of the high-pressure refrigerant gas which is led to the valve chest 123 interior of the above through the aforementioned strainer 122 from the **** room 12, and is led to the crank case 8 side of drawing 1 from the second path 57 of the above through the aforementioned port 114 by this increases (the crank case pressure Pc rises), and the degree of tilt angle of the cam plate 10 of drawing 1 decreases.

[0057] On the other hand, where the aforementioned solenoid 131A is demagnetized, drawing in by the side of the suction child 141 of a plunger 133 disappears, according to the energization force of the aforementioned spring 144, the aforementioned plunger 133 moves to opposite direction the aforementioned suction child 141 side, and the spherical valve element 126 is moved in the direction which opens the valve port 125 of the control valve main part 120 through a rod 132. Although displaced in the direction which the aforementioned bellows 146 will contract [direction] and will decrease the opening of the aforementioned spherical valve element 126 in this state if the suction pressure Ps inside [pressure-sensitive room 145] the above goes up, since it is equipped with the other end 140 of the aforementioned stem 138 free [attachment and detachment] to the stopper 147 of the aforementioned bellows 146, the variation rate of the aforementioned bellows 146 is not influenced to the aforementioned spherical valve element 126.

[0058] Consequently, the spherical valve element 126 is held in the maximum opening position, without being influenced by the suction pressure Ps of the pressure-sensitive room 145 interior

of a rise. moreover, the maximum of bellows 146 -- a variation rate -- since the amount is set up so that it may become smaller than the amount of the maximum fitting of the other end 140 of the aforementioned stem 138, and the stopper 147 of the aforementioned bellows 146, the other end 140 of this stem 138 does not secede from the stopper 147 of this bellows 146

[0059] Thus, when, as for the control valve 100 of this operation gestalt, the aforementioned low-temperature refrigerant gas is introduced from an inhalatorium 13 in the pressure-sensitive room 145 of the aforementioned control valve main part 120, This low-temperature refrigerant gas is led to the low-temperature refrigerant-gas introduction space 85 in which it is prepared between the aforementioned solenoid housing 131 and the aforementioned rear housing 3. Since the whole side of this solenoid housing 131 was cooled by this low-temperature refrigerant gas, the fall of the excitation force by solenoid 131A inside [solenoid housing 131] the above can be suppressed.

[0060] Moreover, since the aforementioned pressure-sensitive room 145 is equipped with the stretching screw electrode holder 152 which has the stretching screw 153 which adjusts the strength of bellows 146 in the state of sealing and the aforementioned stretching screw 153 adjusted the strength of the bellows 146 inside [pressure-sensitive room 145] the above from the exterior of the aforementioned control valve main part 120, the strength of the bellows 146 of the pressure-sensitive room 145 interior can be easily adjusted to a control valve 100. Furthermore, since the aforementioned control valve main part 120 was laid under the rear housing 210 side of the aforementioned variable-capacity type compressor 200 where the aforementioned stretching screw electrode holder 152 is turned outside, even if it is in the state which equipped the rear housing 210 with the control valve main part 120, the strength of the bellows 146 inside [pressure-sensitive room 145] the above can be easily adjusted from the outside.

[0061] Furthermore, since it arranged in the interior of solenoid 131A which draws the aforementioned stem 138 which accomplishes a part of aforementioned operation lever in the direction in which the aforementioned opening by the aforementioned spherical valve element 126 decreases and the point of application by suction of this solenoid 131A to an operation lever and the point of application of the energization force by the aforementioned bellows 146 brought close near the aforementioned pressure-sensitive room 145 again, it is stopped with [of the operation lever at the time of movement in the direction of valve-closing of an operation lever] backlash Moreover, since it is a globular form-like, even if the aforementioned spherical valve element 126 is the case where an inclination arises to the aforementioned rod 132 at the time of a valve-closing operation, it can make the aforementioned spherical valve element 126 contact equally to a valve port 125.

[0062] As mentioned above, although this operation gestalt showed the case where a stretching screw 153 and the stretching screw electrode holder 152 were used as another object, this invention of the ability of the cap 152a structure which shows the important section and which unified the stretching screw and the stretching screw electrode holder like other operation gestalten to be used not only for the above composition but for drawing 5 is natural. This cap 152a has secured the airtight with O ring 154 while it screws adjustment male screw section 152b engraved on the periphery of the aforementioned cap 152a in adjustment female screw section 157a engraved on the inner circumference of a plate 157 and makes centering control free.

[Translation done.]

* NOTICES *

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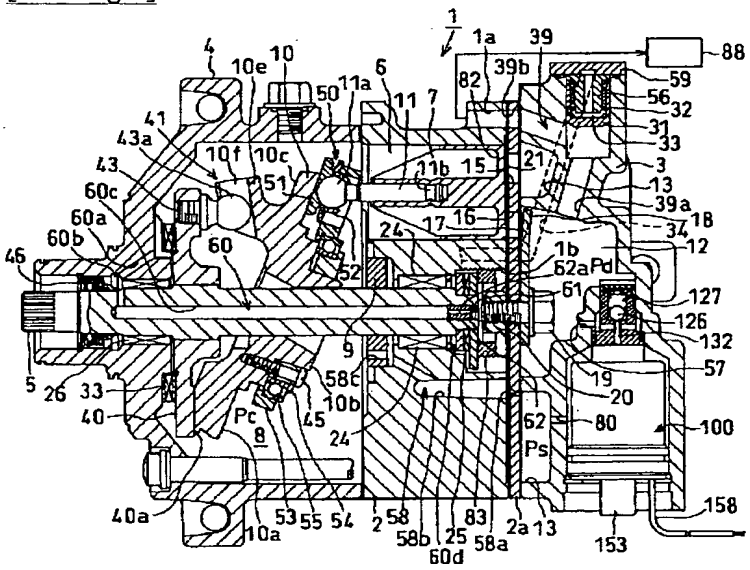
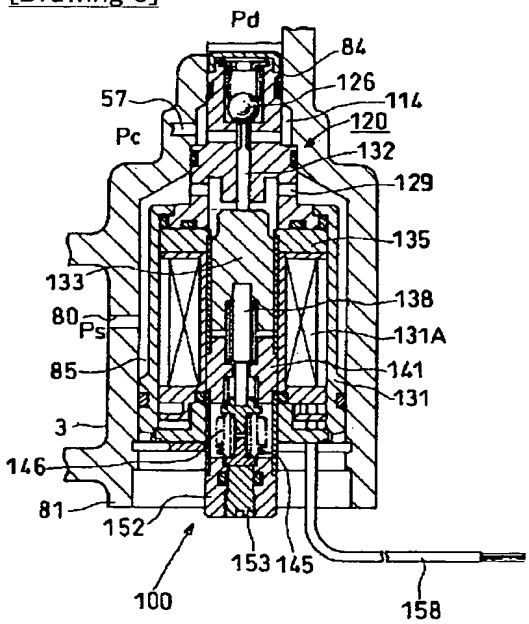
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

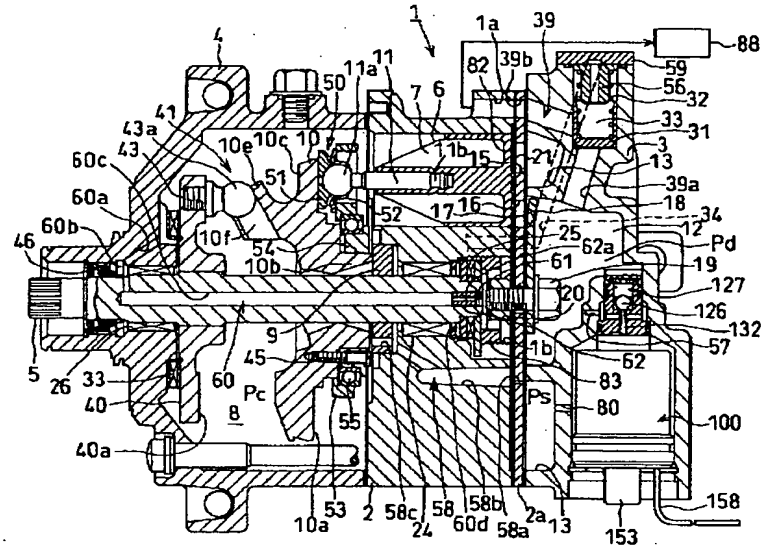
[Drawing 1]



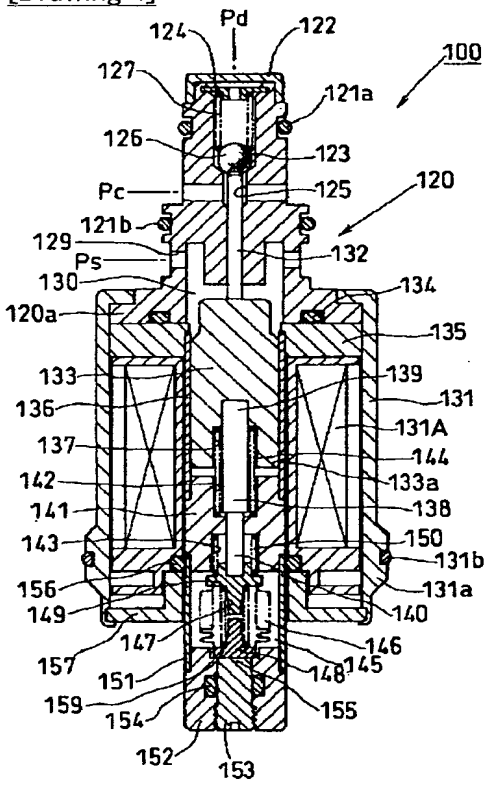
[Drawing 3]



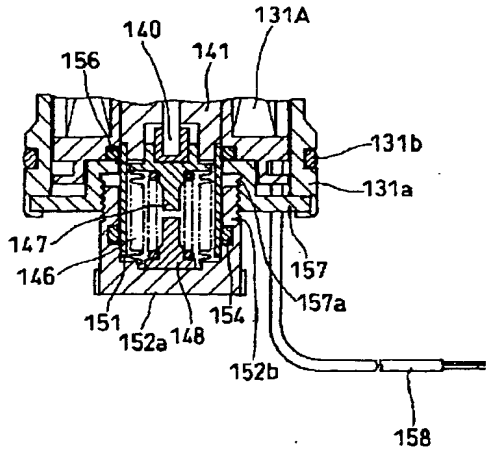
[Drawing 2]



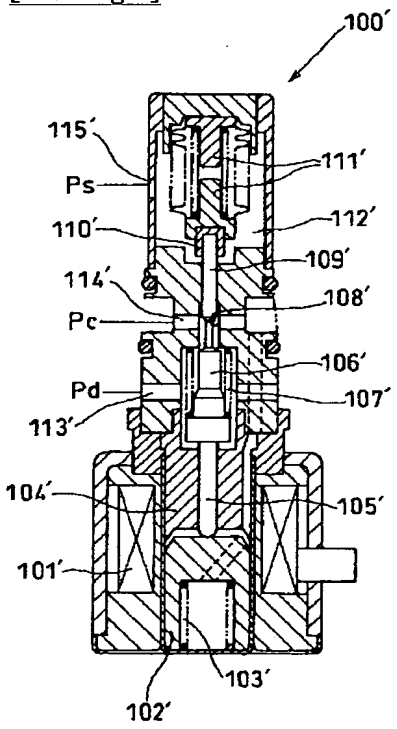
[Drawing 4]



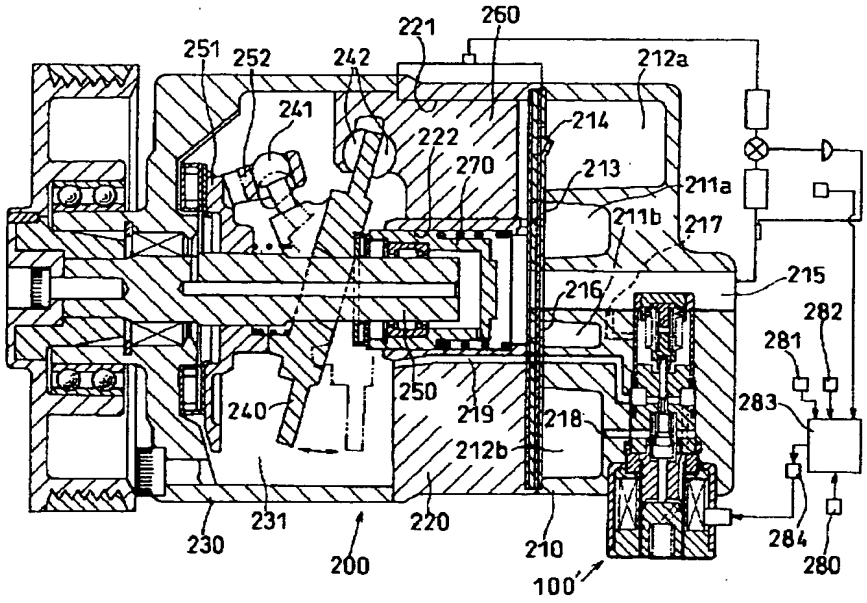
[Drawing 5]



[Drawing 7]



[Drawing 6]



[Translation done.]